A METHOD FOR PREDICTING THE EFFECT OF COMPLEX-EXPLOSION ON STRUCTURES BASED ON A LIMITED NUMBER OF FULL COMPUTATIONS AND A SIMPLE CONWEP COMPUTATION

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The need to conduct parametric investigation where explosives and complex structure are involved requires significant resources including computation time and experienced simulation operators. As an example, when a large amount of explosive that is stored inside a structure explodes, a blast wave is generated. The strength of generated the blast depends on both the explosive (type and weight) and the properties of the storing structure, since part of the blast energy is needed to destroy the structure. If one is to learn about the dynamic load (e.g., pressure and impulse) that is applied by the blast on a neighbor structure, a parametric analysis is needed. To do so, he needs to conduct a set of full numerical simulations with a validated numerical code.

In the present study we present a method which can considerably reduce the number of the full numerical calculations that need to be carried out in order to cover the full parametric range. Specifically for the above example, for a given structure that explosives with variable weights are stored in it, the load developed on a neighbor structure located at different distances depends on the distance between the two structures and the weight of the stored explosive. The different loads developed on the structure at the full range of the parameters are found by means of calibration and interpolation of a simple empirical code results. Only a few full hydrodynamic computations with different amounts of explosives at different distances are required for calibrating the empirical code and obtaining the resulted blast wave loads on a neighbor structure at the full parametric range.

By means of the proposed method, the problem, which as mentioned above needs a full hydrodynamic computation is replaced by an equivalent problem of the explosion of a bare hemispherical charge. The equivalent problem can be solved by means of an empirical model such as ConWep [1], which is very simple to apply. The solution of the equivalent problem results in identical peak pressure and peak impulse at close and far ranges and very similar pressure and impulse profiles at far ranges.

Reference

[1] ConWep, Conventional Weapons Effects, U. S. Army Engineer Waterways Experiment Station, CEWES-SS-R, 20 Aug. 1992.